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GENERAL ELECTRIC COMPANY  
GLOBAL RESEARCH  
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NISKAYUNA, NY 12309

EXAMINER
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BAND, MICHAEL A

ART UNIT	PAPER NUMBER
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1709

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05/16/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/814,693

Applicant(s)

LIPKIN ET AL.

Examiner

Michael Band

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) 34-41 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☒ Claim(s) 3 is/are objected to.
- 8) ☒ Claim(s) 1-41 are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 3/30/2004; 8/12/2005.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date: / .
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-33, drawn to a method, classified in class 204, subclass 192.16.
  - II. Claims 34-39, drawn to a composition, classified in class 420, subclass 303.
  - III. Claims 40-41, drawn to a product, classified in class 428, subclass 544.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process of use and product. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product. See MPEP § 806.05(h). In the instant case, inventions I and II are a method for protecting an article and an article, respectively. The composition can be applied using a variety of sputtering methods, such as PVD (Physical Vapor Deposition), CVD (Chemical Vapor Deposition), and Molecular Beam Epitaxial (MBE) to name a few.
3. Inventions I and III are related as process of use and product. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different

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process of using that product. See MPEP § 806.05(h). In the instant case, inventions I and III are a method for protecting an article and an article, respectively. The product can be applied to a substrate using a variety of sputtering methods, such as PVD (Physical Vapor Deposition), CVD (Chemical Vapor Deposition), and Molecular Beam Epitaxial (MBE) to name a few.

4. Inventions II and III are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the alloy in Group II does not have to be a target. The subcombination has separate utility such as surface strengthening of machine parts.

The examiner has required restriction between combination and subcombination inventions. Where applicant elects a subcombination, and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

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5. During a telephone conversation with Shawn McClintic on April 27, 2007 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-33. Affirmation of this election must be made by applicant in replying to this Office action. Claims 34-41 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species or invention to be examined even though the requirement be traversed (37 CFR 1.143) and (ii) identification of the claims encompassing the elected invention.

The election of an invention or species may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse.

Should applicant traverse on the ground that the inventions or species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions or species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C.103(a) of the other invention.

***Information Disclosure Statement***

6. The information disclosure statement filed August 12, 2005 cites a "European Search Report dated 8/2/2005" as non-patent literature. Said citation has been lined-through because it is not a published document available to the public. However, the Examiner has considered the search report.

***Claim Objections***

7. Claim 3 is objected to because of the following informalities: "0.2 percent". Said claim should read "0.2 atom percent". Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1-3, 6-10, 13-19, and 24-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Jackson et al (US Patent No. 6,287,644).

With respect to claim 1, Jackson '644 discloses a method for forming a continuously-graded bonded coat (i.e. protective coat) (abstract), where "the bond coat is disposed on a substrate, for example a turbine component, to prevent its severe environmental attack, and structural weakening" (col. 4, lines 51-54). A source ingot (i.e.

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target) is used for forming the continuously-graded bond coat (abstract). Jackson '644 also discloses the source ingot (i.e. target) being comprised of about 5.0 to about 40.0 atomic percent of chromium and about 50.0 to less than 100.0 atomic percent of aluminum (col. 3, lines 22-25). Jackson '644 further discloses a variety of manufacturing methods for the bond coat, including Ion Plasma Deposition (col. 6, lines 23-28).

With respect to claim 2, Jackson '644 further discloses that the source ingot comprises various atomic percentage ranges of zirconium, hafnium, silicon, and yttrium (col. 3, lines 22-29).

With respect to claim 3, Jackson '644 further discloses a source ingot (i.e. target) being composed of zirconium in a range of about a trace to 0.5 atom percent, yttrium in a range from about a trace to 2.0 atom percent, and hafnium in a range from about 0.5 to about 2.0 atom percent. However Jackson '644 does not explicitly disclose carbon being present in the ingot. It would be inherent that trace amounts of carbon be present in the target even though Jackson '644 does not discuss this characteristic. As evidenced by Rigney et al (US Patent No. 6,153,313), additions of hafnium, zirconium and yttrium serve to scavenge impurity atoms, such as carbon, that cause a decrease in interface cohesion (col. 6, lines 62-64). *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991).

With respect to claim 6, the reference is cited as discussed for claim 3. Jackson '644 further discloses the source ingot (i.e. target) comprising about 5.0 to 40.0 atomic percent chromium, about 0.5 to 2.0 atomic percent hafnium, about 1.0 to 17.0 atomic

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percent silicon, and about 50.0 to less than 100.0 atomic percent aluminum (i.e. the balance) (abstract).

With respect to claims 7-8, Jackson '644 further discloses two melt pools, one of aluminum and the other of nickel (col. 7, lines 37-39; figure 3, part 85). These two metal are deposited onto the substrate (figure 3, part 60). Jackson '644 further discusses how cobalt can also be incorporated into this layer (part 85) (col. 7, lines 40-44). Figure 3 also depicts "regions 62, 63, 64, 65 and  $62_n$ , where  $n$  equals the number of possible regions that are compositionally distinguished in the continuously-graded bond coat" (col. 8, lines 1-3). The aluminum-nickel region (i.e. metal layer) (part 85) is deposited prior to the protective coating (parts 62- $62_n$ ) as displayed in figure 3.

With respect to claim 9, Jackson '644 further discloses how "the substrate (part 60) can be maintained at a high surface temperature, for example at a temperature in a range from about 950°C to about 1200°C. The high surface temperature permits reaction of the deposited materials (i.e. aluminum and nickel) and the substrate (col. 7, lines 33-40).

With respect to claims 10 and 13-14, Jackson '644 further discloses "heat treatments of the continuously-graded bond coat to form a protective coating at the outer surfaces" (col. 8, lines 60-62) of the substrate. Jackson '644 further discusses how the "heat treatments are provided for about 4 hours at a temperature range of about 1000°C to about 1200°C" (col. 9, lines 1-3).

With respect to claims 15 and 16, Jackson '644 further discloses that "the aluminum in the first-deposited region reacts with the material of the superalloy



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substrate, such as, but not limited to, nickel" (col. 7, lines 30-32). Jackson '644 also discusses "exemplary high-temperature resistant materials [including], but not limited to, nickel-based superalloy materials, iron-based superalloy materials, nickel-iron-based superalloy materials, and cobalt-based superalloy materials (col. 4, lines 29-33). "The following description [*Detailed Description of the Invention*] refers to a nickel-based superalloy material for the substrate material" (col. 4, lines 33-35).

With respect to claim 17, Jackson '644 further discloses that " the invention is related to a continuously-graded aluminide-based bond coat on articles exposed to high temperatures, such as components of turbines and engines" (col. 1, lines 13-16), and in greater detail, "hot-section gas path surfaces in modern jet engines and gas turbines, including buckets, rotors, turbine tips, nozzles, blades, vanes, and airfoils, and their components (hereinafter "turbine components") [that] are exposed to oxidizing gases at high temperatures" (col. 4, lines 22-26). Jackson '644 also states that these components are formed from high-temperature resistant materials, including nickel-based superalloy materials, iron-based superalloy materials, nickel-iron-based superalloy materials, and cobalt-based superalloy materials (col. 4, lines 28-33).

With respect to claim 18, Jackson '644 further discloses "after deposition if the high vapor-pressure materials, subsequent deposits (i.e. coatings) comprise intermediate vapor-pressure materials in regions 62, 63, 64, 65.....,62<sub>n</sub>" (col. 7, lines 66-67; col.8, line 1). This is further evidenced by figure 3, parts 62 through 62<sub>n</sub>.

With respect to claim 19, Jackson '644 further discloses an ingot (i.e. target) composed of various compositions of metals, with the majority of the metal being

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composed of aluminum (abstract). However Jackson '644 is limited in that it does not state how the ingot is produced. It is well known that aluminum is not naturally found as a pure metal. In order to obtain pure aluminum from bauxite, the bauxite must be added to a specified chemical mixture (i.e. Bayer process) to form alumina, and then electrolyzed to precipitate the alumina out of solution as aluminum powder (i.e. Hall-Heroult process) (i.e. powder metallurgy). It is also well known that ingots, as required in Jackson '644 (i.e. aluminum ingots), are commonly formed via casting process. Therefore it is implicit that the ingots of Jackson '644 are made via a powder and casting metallurgy processing as discussed.

With respect to claims 24-26, Jackson '644 further discloses that "the continuously-graded bond coat (i.e. protective coating) (part 105) is typically deposited on a substrate (part 60) in an amount less than a total desired TBCS (Thermal Barrier Coating System) (part 100) thickness. The TBC (Thermal Barrier Coating) (part 101) is then deposited on the continuously-graded bond coat, so the TBC and the continuously-graded bond coat equal the total desired TBCS thickness. For example, if a TBCS with about a 200 micron (i.e. 200 micrometer) total thickness is desired, a continuously-graded bond coat having a thickness in a range from about 50 microns to about 70 microns is first deposited" (col. 9, lines 17-26). This is also supported by figure 4, parts 60, 100, 101, and 105.

With respect to claim 27, Jackson '644 further discloses that a TBC typically comprises a layer that includes zirconia in the form of partially- or fully-stabilized by yttria (col. 1, lines 38-40 and 42-44).

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With respect to claims 28-30, Jackson '644 further discloses that a source ingot (i.e. target) of 99.5Al-0.5Zr will yield an average composition of the continuously-graded bond coat (i.e. protective coat) of 99.75% NiAl (i.e. a single phase) and 0.25% Zr (i.e. NiAl % + Zr % is a double phase) when reacted with the substrate (col. 9, lines 57-62), thus larger than 80% and being a B2-structured aluminide intermetallic (i.e. nickel-aluminum).

With respect to claim 31, Jackson '644 further discloses a bond coat (i.e. protective coat) comprising "an oxidation-resistant alloy, such as MCrAlY, where M is at least one of iron, cobalt and nickel" (col. 1, lines 57-59) (i.e. B2-structured aluminide intermetallic phase). Jackson '644 also discusses that the bond coat can comprise a platinum-aluminide material that form an intermetallic component (col. 1, lines 61-60), and that the bond coats can mechanically interlock the substrate to the TBC (col. 1, lines 61-63).

### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson et al (6,287,644) as applied to claim 3 above.

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With respect to claims 4, the reference is cited as discussed for claim 3. Jackson '644 further discloses the source ingot (i.e. target) comprising about 5.0 to 40.0 atomic percent chromium, about trace to 0.5 atomic percent zirconium, and about 50.0 to less than 100.0 atomic percent aluminum (i.e. the balance) (abstract).

However Jackson '644 is limited in that while it does disclose a range for atomic percent zirconium, the range does not encompass the claimed about 1 atom percent. However it would have been obvious to one of ordinary skill to use 1 atomic percent zirconium for the target since it has been held that a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

12. Claims 5 and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson et al (US Patent No. 6,287,644) as applied to claims 3 and 7 above, and further in view of Rigney et al (US Patent No. 6,153,313).

With respect to claim 5, the reference is cited as discussed for claim 3. Jackson '644 further discloses the source ingot (i.e. target) comprising about 5.0 to 40.0 atomic percent chromium, about a trace to 0.5 atomic percent zirconium, and about 50.0 to less than 100.0 atomic percent aluminum (i.e. the balance). However Jackson '644 is limited in that it does not discuss using an atom percent of tantalum in the target or alloy. Jackson '644 is also limited in that while it does disclose a range for atomic percent zirconium, the range does not encompass the claimed about 1 atom percent.

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However it would have been obvious to one of ordinary skill to use 1 atomic percent zirconium for the target since it has been held that a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

Rigney '313 teaches a coating system for articles used in hostile thermal environments, such as turbine, combustor and augmentor components of a gas turbine engine (abstract). Rigney '313 further teaches that the coating contains a predominant portion of NiAl to promote oxidation resistance, with the coating including additions of chromium, zirconium, and tantalum (abstract). Rigney '313 also teaches that the bond coating is formed via physical vapor deposition (i.e. ion plasma deposition) (col. 5, lines 21-22), and therefore it is inherent that a target is used to apply the bond coating. Table I depicts a preferred bond coating percentage of 0.5-15% chromium, 0.01-0.5% zirconium, 0.1-3.0% tantalum, and a significant portion of the remaining percentage of aluminum (Table I, col. 7). All percentages of the bond coating are in atom percents (col. 6, lines 65-67). Rigney '313 lists the desirable advantages of this compositional bond coating as an increase in creep strength and abilities to getter impurities, increase fracture resistance, and promote oxidation resistance (abstract). Although Rigney '313 discusses the atom percents being of the alloy compositions instead of target compositions, it is inherent that a target would be present in a physical vapor deposition

apparatus and thus obvious to construct the target of a similar material composition as of the desired bond coating.

It would have been obvious to one of ordinary skill in the art to include 0.1-3.0% tantalum taught in Rigney '313 in the target composition of Jackson '644 in order to gain the advantages of gettering impurities, increasing fracture resistance, and promotion of oxidation resistance.

With respect to claims 11 and 12, the reference is cited as discussed for claim 7. However Jackson '644 is limited in that while there is a NiAl layer (i.e. metal layer) inserted between the protective coating and substrate, Jackson '644 does not specify a thickness for the NiAl layer.

Rigney '313 teaches a substrate (part 22) with a NiAl layer (part 24) between said substrate and a protective coating (parts 26 and 28) (figure 2). Rigney '313 states that "an adequate thickness for the NiAl bond coat (part 24) is about 15 micrometers in order to protect the underlying substrate" (col. 5, lines 26-28). Rigney '313 also states "thicknesses of about 10 to about 125 micrometers are believed to be suitable" (col. 5, lines 29-31).

However Rigney '313 is limited in that while it does disclose a range and specific thickness for the NiAl metallic layer, neither the range nor the specific value encompasses the claimed ~2 micrometer to ~6 micrometer thickness of the NiAl layer. However it would have been obvious to one of ordinary skill to use 10 micrometer NiAl thickness for the metal layer since it has been held that a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but

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are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). Furthermore, it would have been obvious to optimize the thickness of the NiAl layer. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Jackson '644 discloses that there is a NiAl layer thickness between the substrate and the protective layer but does not specify a particular value. Rigney '313 teaches a NiAl layer thickness of about 10 micrometers to about 125 micrometers, with a specific value of about 15 micrometers preferred for a similar bond coating system used in high-temperature, high oxidation environments in gas turbines. It would have been obvious to one of ordinary skill in the art to use the NiAl layer thickness of Rigney '313 as the NiAl thickness in Jackson '644 since Jackson '644 fails to disclose a specific metal layer thickness and one of ordinary skill in the art would have a reasonable expectation of success in making the modification.

13. Claims 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson et al (US Patent No. 6,287,644) as applied to claim 1 above, and further in view of Chiang et al (USPGPub 2002/0070375).

With respect to claims 20-23, Jackson '644 further discloses that a power supply heats the materials to cause the bond coat to form onto the substrate (col. 13, lines 29-41). Jackson '644 discusses that power values between the range of 0.5kW and 2.5kW were used (col. 13, lines 30-41). However Jackson is limited in that while power is being used and therefore a voltage, it does not teach the claimed voltage range of the power source.

Chiang '375 teaches a sputtering method of Ion Metal Plasma (i.e. ion plasma) deposition for applying tantalum films (i.e. tantalum coats) by altering the substrate DC offset bias voltage (abstract). Chiang '375 further discusses how the DC power was adjusted over a range from about 1 kW to about 8 kW, with the range being preferable from about 1kW to about 3kW (p. 4, para 42). Figure 2B displays how as the DC power increases from about 1 kW to about 3 kW, the pressure also increases. Chiang '375 discusses how as the process pressure increases, an increase in ion bombardment of the depositing film surface is seen (p. 4, para 45). Chiang '375 further discusses how an increase in ion bombardment of depositing film surface can also be achieved by increasing the DC offset bias voltage of the substrate (p. 4, para 46). The power bias range for this can be seen in figure 3, with the corresponding substrate DC offset bias voltage ranging from about 0 volts to about –150 volts (p. 4, para 46). It is inherent that the substrate is grounded since an electrical potential is running through the substrate as the DC voltage is applied.

Jackson '644 discloses that a power source, and thus a voltage, is applied but does not specify a particular voltage value. Chiang '375 teaches a voltage between 0 volts and –150 volts for a similar ion plasma deposition method. It would have been obvious to one of ordinary skill in the art to incorporate the voltage range of Chiang '313 into the power source of Jackson '644 since Jackson '644 fails to disclose a specific voltage associated with the power source and one of ordinary skill in the art would have a reasonable expectation of success in making the modification.



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14. Claims 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson et al (US Patent No. 6,287,644) in view of Chiang et al (USPGPub 2002/0070375).

With respect to claims 31 and 32, Jackson '644 further discloses that "the aluminum in the first-deposited region reacts with the material of the superalloy substrate, such as, but not limited to, nickel" (col. 7, lines 30-32). Jackson '644 also discusses "exemplary high-temperature resistant materials [including], but not limited to, nickel-based superalloy materials, iron-based superalloy materials, nickel-iron-based superalloy materials, and cobalt-based superalloy materials (col. 4, lines 29-33). "The following description [*Detailed Description of the Invention*] refers to a nickel-based superalloy material for the substrate material" (col. 4, lines 33-35). Jackson '644 further discusses a method for forming a continuously-graded bonded coat (i.e. protective coat) (abstract), where "the bond coat is disposed on a substrate, for example a turbine component, to prevent its severe environmental attack, and structural weakening" (col. 4, lines 51-54). A source ingot (i.e. target) is used for forming the continuously-graded bond coat (abstract). Jackson '644 also discloses the source ingot being comprised of about 5.0 to about 40.0 atomic percent of chromium and about 50.0 to less than 100.0 atomic percent of aluminum (col. 3, lines 22-25). Jackson '644 also states a variety of manufacturing methods for the bond coat, including Ion Plasma Deposition (col. 6, lines 23-28). Jackson '644 further teaches the source ingot (i.e. target) being composed of zirconium in a range of about a trace to 0.5 atom percent, yttrium in a range from about a trace to 2.0 atom percent, and hafnium in a range from about 0.5 to about 2.0 atom

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percent. However Jackson '644 does not disclose carbon being present in the ingot. It would be inherent that trace amounts of carbon be present in the target even though Jackson '644 does not discuss this characteristic. As evidenced by Rigney '313, additions of hafnium, zirconium and yttrium serve to scavenge impurity atoms, such as carbon, that cause a decrease in interface cohesion (col. 6, lines 62-64). *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). Jackson '644 further discloses two melt pools, one of aluminum and the other of nickel (col. 7, lines 37-39; figure 3, part 85). These two metal are deposited onto the substrate (figure 3, part 60). Jackson '644 further discusses how cobalt can also be incorporated into this layer (part 85) (col. 7, lines 40-44) Figure 3 also depicts "regions 62, 63, 64, 65 and 62<sub>n</sub>, where n equals the number of possible regions that are compositionally distinguished in the continuously-graded bond coat" (col. 8, lines 1-3). The aluminum-nickel region (i.e. metal layer, B2-structured aluminide intermetallic) (part 85) is deposited prior to the protective coating (parts 62-62<sub>n</sub>) as displayed in figure 3. Jackson '644 also discloses how "the substrate (part 60) can be maintained at a high surface temperature, for example at a temperature in a range from about 950°C to about 1200°C. The high surface temperature permits reaction of the deposited materials (i.e. aluminum and nickel) and the substrate (col. 7, lines 33-40). However Jackson '644 is limited in that while a power is applied to the process, it does not specifically state if the substrate is biased via negative potential during the deposition.

Chiang '375 teaches a sputtering method of Ion Metal Plasma (i.e. ion plasma) deposition for applying tantalum films (i.e. tantalum coats) by altering the substrate DC

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offset bias voltage (abstract). Chiang '375 further discusses how the DC power was adjusted over a range from about 1 kW to about 8 kW, with the range being preferable from about 1kW to about 3kW (p. 4, para 42). Chiang '375 further teaches that the power bias range for this can be seen in figure 3, with the corresponding substrate DC offset bias voltage ranging from about 0 volts to about -150 volts (p. 4, para 46). Chiang '375 describes the advantage of applying a bias is to increase the ion bombardment of the film surface, thereby decreasing the amount of time necessary to apply the film (i.e. coat) (p. 4, para 45)

It would have been obvious to one of ordinary skill in the art to incorporate applying a negative potential bias to the substrate taught in Chiang '375 to the method of Jackson '644 in order to gain the advantage of decreased film application time.

### ***Conclusion***

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. 5,923,056; US Patent No. 6,475,642; US Patent No. 5,516,380; US Patent No. 6,746,783; US Patent No. 6,746,782; US Patent No. 6,620,525; US Patent No. USPGPub 2003/0138660; USPGPub 2003/0118863 as being related to the state of the art.

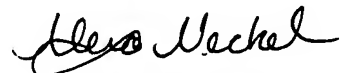
16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

17. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MAB



ALEXA D. NECKEL  
SUPERVISORY PATENT EXAMINER